

196. The process of Claim 182 or Claim 187 wherein the carbon source is vaporized in a bell jar carbon evaporator.

197. The process of Claim 182 or Claim 187 wherein the carbon source subject to vaporization is graphite or amorphous or glassy carbon.

198. The process of Claim 197 wherein the carbon source subject to vaporization is graphite.

199. The process of Claim 182 or Claim 187 wherein the carbon source subject to vaporization is graphite rods.

200. The process of Claim 182 or Claim 187 wherein the carbon source is vaporized by passing an electrical current of sufficient intensity through said carbon source to produce the sooty carbon product.

201. The process of Claim 182 or Claim 187 wherein the inert quenching gas is a noble gas.

202. The process of Claim 201 wherein the noble gas is helium or argon.

203. The process according to Claim 62 wherein ~~recovering~~^{extracting} further comprises evaporating the solvent off, thereby forming a residue, and subliming the C₆₀ from said residue.

REMARKS

The Office Action has rejected Claims 45-180 under 35 U.S.C. §112, second paragraph as allegedly being indefinite. In addition, Claims 45-180 are rejected under 35 U.S.C. §112, first paragraph, as allegedly failing to adequately describe the invention and for allegedly being non-enabling. Furthermore, Claims 45-46, 50-51, 55-58, 66, 68-71, 73-74, 83-87, 89, 97, 99-102, 104-105, 114-115, 118-121, 124-128, 131-135, 138-150, 152-154, 158, 160-168, 171-175 and 177-178 are rejected as allegedly being anticipated by Huffman, et al. in Nature Physical Science, 1973, 243, 50-51 ("Huffman et al.")

with an article by Iijima in J. Phys. Chem., 1987 91, 3466-3467 ("Iijima") being cited to allegedly "show inherent states of fact". Furthermore, Claims 45-180 are rejected under 35 U.S.C. §103 as defining subject matter which is allegedly rendered obvious by the teachings of Huffman et al. in view of Iijima and Russian Patent SU 1,587,000 ("Russian Patent"). In addition, Claims 45-46 (68-71)/45, (73-74)/45, 83, 85, (99-102)/83, 104-105/83, 114-115, 118-121, 124, 126, 128/124, 131-135, 138-149, 152-154, 158, 160-163, (167-168)/163, 172-175, and 177-178 are rejected under 35 U.S.C. §102(b) as allegedly being anticipated by the teaching in U.S. Patent No. 2,957,756 to Bacon ("Bacon"). Finally, Claims 45-46, 50-51, 58, 66, 68-75, 83-85, 89, 97, 99, 100-106, 114-115, 118-121, 124-128, 131-150, 152-155, 158-163 and 171-178 are rejected under 35 U.S.C. §102(b) as allegedly being anticipated by an article by Kappler et al. in J. App. Phys., 1979, 50, 308-316 ("Kappler et al").

In response thereto, applicants have amended claims. In addition, they are submitting herewith a Declaration under 37 C.F.R. §1.132 by Harold Kroto ("Kroto Declaration"), a world renowned expert in the field of fullerenes. It is respectfully submitted that the amendment to the claims and the Declaration in combination with the comments hereinbelow are deemed to place the present case in condition for allowance. Favorable reconsideration is respectfully requested.

At the outset, applicants wish to thank Examiners Lewis and DiMauro for conferring with applicants' representatives on February 23, 1995 and for the kindness and courtesy extended to them.

The objections to the drawings are noted; formal drawings will be submitted after receipt of the Notice of Allowance.

Claim 66 was amended to recite that the vaporization occurs in a vessel which has previously been evacuated. Support is found on Page 6, Line 23 to Page 7, Line 10 of the instant specification.

Applicants have also amended Claims 45, 50, and 160 and claims dependent thereon by reciting therein the term "macroscopic amounts". By definition, "macroscopic" means large enough to be observed by the naked eye. See Webster's Ninth New Collegiate Dictionary, 1985, p. 714, a copy of which is attached. Support for this term and concept permeate the specification. For example, attention is directed to Page 7, Lines 10-25, Page 8, Lines 3-16 and to Example 1 of the instant specification wherein the color of the product produced therefrom is indicated. Obviously, one cannot determine color unless it is present in amounts that can be seen with the naked eye, i.e., macroscopic amounts. Furthermore, attention is directed to Figure 2, wherein an X-ray diffraction pattern is provided of a product produced in accordance with the present invention. As the skilled artisan is well aware, macroscopic quantities had to be available to generate a X-ray diffraction of the product. In addition, attention is directed to Page 11, Line 30 of the instant specification wherein it is indicated that the IR is taken of an approximately two micrometers thick C₆₀ coating on a silicon substrate. Especially since C₆₀ is colored, this coating is seen with the naked eye.

Case law has held that satisfaction of the description requirement requires that the disclosure of the application conveys to the skilled artisan that the inventor had possession at the time of filing of the application of the claimed subject matter. Vas-Cath Inc. v. Mahurkar, 935 F.2d 1555, 19 USPQ 2d 1111 (Fed. Cir. 1991). Attention is directed to the Kroto Declaration, paragraphs 14 and 15, wherein he

states that the application is enabling and describes the preparation of fullerene, e.g., C_{60} or C_{70} , in macroscopic amounts. Thus, there is adequate description support in the application for the term.

Although the term is not used explicitly in the application, there is definitely implicit support for the term upon which to base generic claim language. See, In re Robins, 429 F.2d 452, 166 USPQ 550 (CCPA 1970).

Claims 181-203 were added to the application. The subject matter in Claim 181 recites the subject matter that was present in Claim 45 prior to the amendment. The subject matter in Claim 203 is directed to placing the soot in an organic solvent and evaporating off the solvent and sublimating the C_{60} from the resulting residue. Support is found in Example 1 of the instant specification.

Claims 182-202 are directed to the process for preparing "a fullerene" in "macroscopic amounts". With respect to the term "macroscopic amounts", applicants reiterate the comments hereinabove. Applicants also submit that there is ample support in the specification for the term "a fullerene". This concept also permeates the instant specification. For instance, the application specifically discusses C_{60} , C_{70} and C_{240} . Each of these molecules is a fullerene. See ¶16 of Kroto Declaration and Exhibit 6 attached thereto. C_{60} is fullerene-60, C_{70} is fullerene-70 and C_{240} is fullerene-240. The application also refers to an allotrope of carbon (e.g., see Claim 27, Page 16, Line 26 of the instant application), compounds made of solely carbon atoms soluble in non-polar organic solvents (e.g., see Page 3, Line 30 to Page 6, Line 6), soccer ball and carbon caged compounds made solely of carbon atoms (see, e.g., Page 11, Lines 8-11 of the instant specification). All of these terms connote fullerenes. Again,

the specification conveys to the skilled artisan that fullerenes were in the possession of the applicant at the time of the filing of the application. In this regard, attention is directed to Paragraph 15 of the Kroto Declaration wherein he states:

In my professional judgement, the above-identified application adequately teaches to the skilled artisan how to make macroscopic amounts of fullerene, including C₆₀ and C₇₀; furthermore, there is ample evidence in the application that Huffman and Kratschmer had in their possession macroscopic amounts of these products.

Again, there is implicit support for these concepts and terms in the application upon which to base generic claim language. See, In re Robins, 429 F.2d 452, 166 USPQ 550 (CCPA 1970).

This present situation is not unlike that in In re Smythe, 480 F.2d 1376, 178 USPQ 279 (CCPA 1973). In Smythe, the invention related to a "continuous automatic analysis system where discrete liquid samples...are successfully introduced into an apparatus as a continuous stream, the individual samples being separated by a segmentizing medium." Both the specification and original claims identified this medium as "air or other gas which is inert to the liquid." The applicant later added claims that described the medium as "inert fluid". The USPTO rejected the added claims on the basis of the description requirement, but the Smythe Court reversed, stating that the use of the term "inert fluid" would naturally occur to the skilled art reading the description of the use of air or other gas as a segmenting medium to separate the liquid samples. Id at 1384, 178 USPQ at 285. The court provided its rationale as follows:

....[W]hereas the broader concept of using "inert fluid" would naturally occur to one skilled in the art from reading appellants' description of the use and functions of the segmenting medium specifically described, we see no basis for denying appellants the claims which recite the segmenting medium

broadly as "an inert fluid". The alternative places upon patent applicants, the Patent Office, and the public the undue burden of listing, in the case of applicants, reading and examining, in the case of the Patent Office, and printing and storing, in the case of the public, descriptions of the very many structural or functional equivalents of disclosed elements or steps which are already stored in the minds of those skilled in the arts, ready for instant recall upon reading the descriptions of specific elements of steps.

We are not saying that the disclosure of 'air or other gas which is inert to the liquid' sample by itself is a description of the use of all 'inert fluid' media. Rather, it is the description of the properties and functions of the 'air or other gas' segmentizing medium described in appellants' specification which would suggest to a person skilled in the art that appellants' invention includes the use of 'inert fluid' broadly...

A hypothetical situation may make our point clear. If the original specification of a patent application on the scales of justice disclosed only a 1-pound 'lead weight' as a counterbalance to determine the weight of a pound of flesh, we do not believe the applicant should be prevented, by the so-called 'description requirement' of the first paragraph of §112, or the prohibition against new matter of §132, from later claiming the counterbalance as a 'metal weight' or simply as a 1-pound 'weight', although both 'metal weight' and 'weight' would indeed be progressively broader than 'lead weight', including even such an undisclosed, but obviously art-recognized equivalent, 'weight' as a pound of feathers. The broader claim language would be permitted because the description of the use and function of the lead weight as a scale counterbalance in the whole disclosure would immediately convey to any person skilled in the scale art the knowledge that the applicant invented a scale with a 1-pound counterbalance weight, regardless of its composition. (Emphasis in original)

Likewise, as attested to by Kroto in his declaration, there is adequate description in the instant specification to convey to the skilled artisan that applicants have invented a process for preparing macroscopic amounts of fullerenes, e.g., C₆₀ or C₇₀. Thus, there is adequate support in the

specification for the terms "macroscopic" and "fullerenes" to be recited in the claims.

Applicants have also canceled Claims 85-95 and 97-159 without prejudice. However, applicants have not abandoned the subject matter therein and reserve the right to file a continuation application thereon. Nevertheless, any rejections of those claims are rendered moot by their cancellation.

The Office Action has rejected the claimed subject matter under 35 U.S.C. §112, second paragraph, as allegedly being indefinite. In particular, the Office Action alleges that the term "recovering from said sooty product" is unclear. As recited in the claimed subject matter, the claims require "recovering a macroscopic amount of product from the soot." This language denotes to one skilled in the art that one obtains macroscopic amounts of product from the soot. There is no ambiguity in this language and it adequately conveys to the skilled artisan that which is claimed. With respect to the rejection of the term "recovering predominantly said C_{60} in solid form", as recited in Claims 181 and Claim 45, that language is also clear to the skilled artisan to denote that the soot contains mostly C_{60} , which can be recovered as a solid from the soot.

The Official Action also objects to the use of terms such as, "said C_{60} molecules being present in said sooty carbon product in amounts capable of extracting and recovering predominantly therefrom said C_{60} in solid form" and said " C_{60} molecules being present in said sooty carbon product in amounts sufficient to be capable of providing a visibly colored solution when extracted with benzene". The Office Action alleges that language is unclear, and that it does not specify a lower limit. Applicants contend that the language clearly defines the invention. The skilled artisan would understand

that the language denotes that the C₆₀ molecules are present in the soot in such quantities that C₆₀ can be extracted and recovered predominantly therefrom as a solid or that a color solution would result when the soot is extracted with benzene and a product is recovered in the benzene solution. Obviously, this language connotes to the skilled artisan that appreciable amounts of product, i.e., macroscopic amounts, are present in the soot in order for these characteristics to be observed. Case law has held that lower limits need not be recited to comply with 35 U.S.C. §112, second paragraph. See, In re Kirsch, 498 F.2d 1389, 1393-1394, 182 USPQ 286, 290 (CCPA 1974). The language utilized reasonably conveys to the skilled artisan the amounts being claimed and therefore, the claims adequately comply with 35 U.S.C. §112, second paragraph.

With respect to Claim 58, the Office Action alleges that it is unclear whether C₇₀ which is present in the soot is separated from the C₆₀. The separation of C₆₀ from C₇₀ is recited in Claim 59. Claim 58 only requires that C₇₀ is recovered from the soot. Again, the metes and bounds thereof are sufficiently understood to the skilled artisan.

Thus, for the reasons provided the rejection of the claimed subject matter under 35 U.S.C. §112, is obviated, and withdrawal thereof is respectfully requested.

The Office Action has rejected the claimed subject matter under 35 U.S.C. §112, first paragraph, for allegedly failing to describe the invention claimed and for allegedly being non-enabling.

Applicants reiterate the arguments provided hereinabove with respect to the compliance of the application relative to the description requirement. As described herein, compliance with the description requirement reasonably conveys to the skilled artisan that the inventor had possession at the

time of the filing of the application of the claimed subject matter. See, Vas-Cath, Inc. v. Mahurkar, 935 F.2d 1555, 1563, 19 USPQ 2d 1111, 1117 (Fed. Cir. 1990). Reference is made to the Declaration of Kroto, paragraphs 3, 13, 14 and 15 wherein he attests that "there is ample evidence in the application that Huffman and Kratschmer had in their possession macroscopic amounts of these products [fullerenes]." Thus, the application reasonably conveys to the skilled artisan that applicants had in the possession at the time of filing the application a methodology for preparing macroscopic amounts of fullerenes. The usage of the terms "carbon allotrope", "caged molecules comprised solely of carbon atoms" etc. are terms to denote "fullerenes". Thus, for the reasons given herein, the specification fully complies with the description requirement of 35 U.S.C. §112.

In addition, the specification fully complies with the enablement requirement of 35 U.S.C. §112, first paragraph, and adequately teaches one skilled in the art how to make the claimed invention without an undue amount of experimentation. The specification provides the general teaching to the skilled artisan of how to prepare fullerenes. Although it provides detail, in particular, with respect to two species, the preparation of other fullerenes can be practiced by the skilled artisan utilizing the methodology therein by modifying the parameters without an undue amount of experimentation. Attention is again directed to the Declaration of Kroto, paragraphs 3, 8 and 15, wherein he attests that the application adequately describes how to make fullerenes, including C₆₀ and C₇₀, in macroscopic amounts. Contrary to the allegation of the Examiner, the law does not require the applicant to describe in his specification every conceivable embodiment of the invention. US v. Teleelectronics, 857 F.2d 778, 786, 8 USPQ 2d

1217, 1222 (Fed. Cir. 1988) (citing SRI Int'l v. Matsushita Elec. Corp. of America, 775 F.2d 1107, 1121, 227 USPQ 577, 586 (Fed. Cir. 1985)). Thus, the specification adequately teaches to the skilled artisan how to make fullerenes, caged molecules, consisting solely of carbon atoms, an allotrope of carbon, etc. Therefore, the rejection of the claims under 35 U.S.C. §112, first paragraph, is obviated and withdrawal thereof is respectfully requested.

In support of the rejection of Claims 45, 46, 50, 51, 55, 58, 66, 68-71, 73-74 and 83-85, 160-168, 171-175 and 177-178 under 35 U.S.C. §102(b), the USPTO cites Huffman et al. in combination with Iijima.

The Huffman et al. reference describes an attempt by the authors to find a model which produces a UV spectrum which matches the UV spectrum of the interstellar extraction curve. Contrary to the allegations in the Office Action, the article is not directed to C₆₀, C₇₀ or fullerenes. The article does not teach or disclose that C₆₀, C₇₀ or any other fullerene is produced by the method described therein. In fact, the article does not mention C₆₀, C₇₀ or fullerene at all; the gist of the article is directed to an entirely different issue. This reference does not teach nor does it claim to teach a method for the production of C₆₀, C₇₀ or any other fullerene. Furthermore, there is no evidence of the production of any such products. See Kroto Declaration, paragraph 9. Thus, the reference does not teach the process of making the C₆₀, C₇₀ or other fullerene in appreciable amounts and recovery thereof, as presently claimed. Therefore, the reference does not teach or disclose the claimed process.

In an attempt to overcome the deficiency in Huffman et al., the USPTO cites Iijima to support its unsubstituted

allegation that in view of Iijima, C₆₀ was inherently produced in the Huffman et al. reference.

Iijima discloses a process for evaporating carbon by arc discharge under vacuum between two carbon rods. It alleges that C₆₀ is produced in minute amounts. It is noted that the process disclosed in Iijima is different from that of the Huffman et al. reference. Unlike the present process, in which carbon is vaporized in the presence of an inert gas, the process described in Iijima is performed in a vacuum, i.e., in the absence of any gas. Yet, the USPTO ignores this difference, and asserts that fullerenes are produced when carbon is vaporized by arc discharge.

The USPTO has the initial burden of establishing prima facie case to deny patentability. Ex parte Levy, 17 USPQ 2d 1461, 1463-1464 (Bd. Pat. App. and Int. 1990). In relying upon the theory of inherency, the USPTO must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied art. In re King, 801 F.2d 1324, 231 USPQ 136 (Fed. Cir. 1986).

The USPTO has not met its burden. Although, Iijima alleges that he saw a molecule of C₆₀ in the middle of the carbon particle, the electron micrograph of Figure 1 does not clearly support the formation of C₆₀. His conclusion is entirely speculative and unsupported by the evidence. See Kroto Declaration, paragraph 9. It is clear from reading Iijima that he was unable to produce C₆₀ or any other fullerene in any appreciable amounts to characterize the product, as presently claimed. As attested to by Kroto in his declaration, it cannot be stated with certainty that Iijima produced C₆₀. Therefore, it cannot be stated with any certainty that C₆₀ was produced in the Huffman et al. reference.

Furthermore, the USPTO may not argue that C₆₀ may have possibly been produced in the Huffman et al. reference. Inherency may not be established by possibilities or probabilities; the mere fact that something may result from a given set of circumstances is not sufficient to establish inherency. Continental Can Co., USA Inc. v Monsanto Co., 948 F.2d 1264, 1269, 20 USPQ 1746, 1749 (Fed. Cir. 1991).

Moreover, even assuming, pro arguendo that the Huffman et al. reference produced C₆₀, it is clear that any C₆₀ that would have been produced was an accidental prior occurrence that was not recognized until after the discovery described in the present application. Even if that accidental prior occurrence took place, that does not constitute anticipation. Tilghman v. Proctor, 102 US 707 (1881).

The invention claimed by Tilghman in his application was the manufacture of fatty acids and glycerol from fats by utilizing water at a high temperature and pressure. Prior to the filing of the Tilghman application, there were known processes for making soap and candle making which although incidentally formed fatty acids, were held not to an anticipation of the process of Tilghman.

.... [The prior art] revealed no process for the manufacture of fatty acids. If the acid were accidentally and unwittingly produced, whilst the operators were in pursuit of other and different results without exciting attention and without its even being known what was done or how it had been done, it would be absurd to say this was an anticipation of the Tilghman discovery.

Id., at 711-712.

Therefore, even if some C₆₀ were produced in the Huffman et al. reference, this was not the intent. There was no excitement generated by the reference. If C₆₀ were produced, it was without it ever being known. Therefore, just as in Tilghman,

it would be just as absurd to say that the reference was an anticipation.

Moreover, even if C₆₀ were made in the Huffman et al. reference, there was no recovery of same, as presently claimed. The absence of any one element in the claim negates novelty, Kolster Speedsteel AB v. Crucible Inc., 793 F.2d 1565, 230 USPQ 81 (Fed. Cir. 1986). Thus, for the reasons given herein, the Huffman et al. reference does not anticipate the present invention and thus, the rejection of the claimed subject matter under 35 U.S.C. §102(b) is obviated.

In support of the rejection of the claimed subject matter under 35 U.S.C. §103, the Office Action cites the reference to Huffman et al. in view of Iijima and the Russian patent.

Applicants reiterate the arguments herein with respect to the Huffman et al. reference and Iijima. As stated hereinabove, there was no evidence that any fullerenes were prepared in the Huffman et al. reference. The combination would not teach, disclose or even suggest the preparation of macroscopic amounts of fullerenes, or the recovery of same, as presently claimed.

The citation of the Russian patent does not overcome this deficiency.

In the Russian patent, the process is carried out on melts containing carbon and iron, and impregnation is carried out with lanthanoids. According to the reference, the CnLa are extracted by boiling in toluol. This system is unlike the present system since the carbon soot of the present invention does not contain any metals. Thus, the system as well as the material being extracted in the Russian patent is quite different from the present system, which contains soot comprising fullerenes, e.g. C₆₀. Thus, the goals in the

Russian article are to separate C_nLa from the melt, which is quite different from that of the present invention.

As one skilled in the art is well aware, the success of an extraction of a material from a mixture or suspension is dependent upon the substances present therein. If the substances present in the mixture or suspension are different, it is not possible to extrapolate the results of one system to another. More specifically, the Russian patent fails to teach, disclose or suggest that fullerene, e.g., C_{60} , is being separated or extracted from a soot, as presently claimed. The reference discloses the extraction of C_nLa from an entirely different material. There is nothing in the prior art that equates the conditions in the Russian patent with the conditions in the present invention. Thus, even if the C_nLa is soluble in toluol, there is nothing in the Russian patent that would suggest that the fullerenes, e.g., C_{60} , produced in the present invention would be soluble in a non-polar solvent, as presently claimed. Furthermore, even assuming, pro arguendo, that the Russian patent could be used as a reference to suggest that C_{60} would be soluble in a non-polar solvent, there is nothing therein that would suggest that the C_{60} could be separated from the soot by utilizing a non-polar solvent, as presently claimed.

With respect to the sublimation step, the Official Action states that it is well known to sublime organic soluble species to purify them and thus it alleges that it would have been obvious to sublime fullerenes from the soot or toluene extracted material of the references.

But even assuming, pro arguendo, that the present process utilizes a known scientific principle, as alleged by the Office Action, that alone does not make the process obvious. Uniroyal Inc. v. Rudkin Wiley Corp., 837 F.2d 1044, 5

USPQ 2d 1434 (Fed. Cir. 1988). There is no suggestion in any of the references to make the modifications suggested in the Office Action. Thus a prima facie case has not been made.

It appears that the United States Patent and Trademark Office has based its rejection on hindsight. It is important to remember that the inventors were recovering fullerenes for the first time. A priori, it was not known whether non-polar solvents or sublimation would have been useful to separate the fullerenes from the soot. There is nothing in the prior art to suggest that the teachings in the Russian patent are applicable to the present system. It is submitted that the Office Action reconstructed the present invention from the prior art by using the claim as a blueprint. This is impermissible under 35 U.S.C. §103. Interconnect Planning Corp. v. Feil, 774 F.2d 1132, 227 USPQ 543 (Fed. Cir. 1985). There is no motivation to combine the references as the Office Action has done.

Moreover, based upon the record, applicants have antedated the Russian patent and thus, it is improper to use it as a reference. It is noted that the publication date of the Russian patent is August 23, 1990. However, attention is directed to the article entitled "Solid C₆₀, a New Form of Carbon", which was published in the 27th September 1990 issue of Nature, 347 p. 358. The present inventors are authors of this article. On Page 347, it states:

...The starting material for our process is pure graphitic carbon soot (referred to below as simple soot) with a few percent by weight of C₆₀ molecules, as described in refs 21, 22. It is produced by evaporating graphite electrodes in an atmosphere of ~100 torr of helium. The resulting black soot is gently scraped from the collecting surfaces inside the evaporation chamber and dispersed in benzene. The material giving rise to the spectral features attributed to C₆₀ dissolves to produce a wine-red to brown liquid, depending on the concentration. The liquid is then

separated from the soot and dried using gentle heat, leaving a residue of dark brown to black crystalline material. Other non-polar solvents, such as carbon disulfide and carbon tetrachloride, can also dissolve the material...(emphasis added).

The process is an embodiment of the present invention. As shown on the back page, this article was received by the publishers of Nature on August 7, 1990. Thus, it is clear that the present inventors prepared macroscopic amounts of fullerenes such as C_{60} and separated the same from the soot at least as early as August 7, 1990 and prior to August 23, 1990, the publication date of the Russian patent. Consequently, this Russian patent has been antedated and cannot be used as a reference.

Moreover, the USPTO has also ignored the obvious. If the present process was so obvious, as alleged by the USPTO why did it take until 1990, 17 years after the publication of the Huffman et al. reference to find the methodology to prepare fullerenes, e.g. C_{60} or C_{70} ?

It is important to remember that the discovery of Huffman and Kruschmer for the formation of fullerenes described in the application fulfilled a long felt need. As described in Paragraphs 11 and 12 of the Kroto Declaration, after the initial detection of C_{60} by the Smalley and Kroto groups, attempts were tried by many experts in the field for five long years to prepare fullerenes on a larger scale, but all were unsuccessful until Huffman and Kruschmer developed the methodology described in the present application. This is further emphasized by the Smalley group in the article entitled "Fullerene" by Robert F. Curl and Richard Smalley printed in Scientific American 1991, pp. 54-62.

Thus, for five years, we had been searching for a method of producing visible amounts of the stuff. We call our efforts "the search for the vial" because quantum

calculations for such a soccer ball shaped carbon molecule suggested it would absorb light strongly only in the far violet of the spectrum....
Curl, et al. at 55.

Furthermore, the preparation of the material in larger amounts was not trivial; other scientists in the field were also unsuccessful:

...We were not alone. Our initial "soccer ball" proposal published in Nature in 1985 had made the quest one of the hottest in chemistry.

In our laboratory we collected the sooty carbon produced by the vaporization laser while using various chemical techniques to detect the presence of C_{60} . We slurried the soot in benzene, for example, and looked for a yellow color. But, the solution in our test tubes stayed clear, with boring black soot sitting on the bottom. The community of cluster chemists ran many more sophisticated experiments but achieved no better result.

Many gave up hope of ever seeing the yellow vial. They reasoned that although the fullerenes may be stable, it was too hard to separate them from the other sooty material being produced in the vaporization experiments. Perhaps, the workers said some dedicated chemist might one day extract a few micrograms with some special solvent, but no one seriously expected C_{60} to be available in bulk anytime soon. Id at 55-56.

Thus, even armed with the teachings of the cited reference in combination, no one in the "hottest quest in chemistry" was able to make macroscopic amounts of fullerenes including C_{60} , until the present inventors had found the proper methodology, as described and claimed in the present application.

Inasmuch as the present inventors have fulfilled a long felt need, this is cogent evidence that the claimed invention is unobvious. In re Dow Chemical Company, 837 F.2d 469, 5 USPQ 2d 1529 (Fed. Cir. 1988).

Therefore, the rejection of the claimed subject matter under 35 U.S.C. §103 is obviated and withdrawal thereof is respectfully requested.

In support of the two rejections of the claimed subject matter under 35 U.S.C. §102(b), the Office Action cited Bacon and Kappler et al. However, as stated in the Kroto Declaration in Paragraph 9, those references do not make any assertion that C_{60} or C_{70} or any other fullerene were made, and there is no evidence that fullerenes were made in these disclosures. Despite the deficiency, the USPTO alleges that the two reference inherently make C_{60} .

Applicants reiterate the discussion hereinabove with respect to the Huffman et al. reference, which comments are incorporated herein by reference. Inasmuch as there is no evidence that C_{60} was made in these references, the statements in the USPTO are purely speculative and unsupported. Thus, it cannot be stated that C_{60} or other fullerenes are necessarily present in the reference, and as attested by Kroto, it is not so recognized by persons of ordinary skill in the art. Therefore, the USPTO has not met its burden for establishing that these reference inherently make C_{60} .

Furthermore, there is no teaching in these references that the authors necessarily recovered any fullerenes, e.g., C_{60} , or that macroscopic amounts were produced and recovered -- necessary elements of the claimed invention. Thus, the reference does not teach every element of the claimed invention.

Therefore, the rejection of the claims under 35 U.S.C. §102(b) is obviated, and withdrawal thereof is respectfully requested.

Applicants take note of the other cited references, but respectfully submit that they are not pertinent.

Thus, in view of the amended claims, the Kroto Declaration and the comments herein, it is respectfully submitted that the present case is in condition for allowance which action is earnestly solicited.

Respectfully submitted,



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